Vertical TEC Mapping Function Analysis for ionospheric Shell Model

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A dual-frequency Global Positioning System (GPS) receiver can be used to measure ionospheric total electron content (TEC) along the lines-of-sight to several (6-10) GPS satellites simultaneously. This capability has been exploited to form maps of the vertical TEC over regions of the globe using GPS data from a single receiver or a network of receivers. The maps typically employ the assumption of an ionospheric shell model: ionospheric electron density is assumed to be concentrated in a shell of uniform density at a fixed height. A thin shell mapping function, which depends on elevation and shell height, is used to convert the slant TEC measurements to equivalent vertical TEC values.

The accuracy of several thin shell mapping functions has been systematically investigated using mapped vertical TEC data from the global GPS network and zenith data from the TOPEX dual-frequency altimeter. Slant and zenith data from different GPS receivers that intersect the ionospheric shell at nearly the same location and time have been used to verify the GPS-TOPEX results. Furthermore, electron density profiles generated by the Parameterized Ionospheric Model (PIM) and the Bent ionospheric model are numerically integrated to derive slant and vertical TEC values. Consistency between the model predictions and the empirical results is investigated.

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